

## Dorsey, Nancy

---

**From:** Boak, Jeremy M. <jboak@ou.edu>  
**Sent:** Tuesday, March 29, 2016 3:53 PM  
**To:** Dorsey, Nancy  
**Subject:** Re: OGS quote on % of HF versus produced water disposed?

I sure understand that!

Jeremy Boak, Director  
Oklahoma Geological Survey  
Mewbourne College of Earth & Energy  
University of Oklahoma  
Sarkeys Energy Center, N119  
100 E. Boyd Street  
Norman OK 73019  
405-325-7968  
jboak@ou.edu

---

**From:** "Dorsey, Nancy" <[Dorsey.Nancy@epa.gov](mailto:Dorsey.Nancy@epa.gov)>  
**Date:** Tuesday, March 29, 2016 at 3:51 PM  
**To:** Jeremy Boak <[jboak@ou.edu](mailto:jboak@ou.edu)>  
**Subject:** RE: OGS quote on % of HF versus produced water disposed?

☺ Understood! I have a long list of references and great articles. It is just trying to locate the one that had the quote needed...searching can take a while, particularly when you are looking at the wrong authors.

---

**From:** Boak, Jeremy M. [<mailto:jboak@ou.edu>]  
**Sent:** Tuesday, March 29, 2016 3:50 PM  
**To:** Dorsey, Nancy <[Dorsey.Nancy@epa.gov](mailto:Dorsey.Nancy@epa.gov)>  
**Subject:** Re: OGS quote on % of HF versus produced water disposed?

I began to recognize this, but every once in a while, someone has missed this paper!

Jeremy Boak, Director  
Oklahoma Geological Survey  
Mewbourne College of Earth & Energy  
University of Oklahoma  
Sarkeys Energy Center, N119  
100 E. Boyd Street  
Norman OK 73019  
405-325-7968  
[jboak@ou.edu](mailto:jboak@ou.edu)

---

**From:** "Dorsey, Nancy" <[Dorsey.Nancy@epa.gov](mailto:Dorsey.Nancy@epa.gov)>  
**Date:** Tuesday, March 29, 2016 at 3:48 PM  
**To:** Jeremy Boak <[jboak@ou.edu](mailto:jboak@ou.edu)>  
**Subject:** RE: OGS quote on % of HF versus produced water disposed?

Thanks, I am actually very familiar with the topic.

---

**From:** Boak, Jeremy M. [<mailto:jboak@ou.edu>]  
**Sent:** Tuesday, March 29, 2016 3:31 PM  
**To:** Dorsey, Nancy <[Dorsey.Nancy@epa.gov](mailto:Dorsey.Nancy@epa.gov)>  
**Subject:** Re: OGS quote on % of HF versus produced water disposed?

Nancy

You may not have time right now, but the paper is a very good, relatively simple and straightforward description of the evidence for the earthquakes in Oklahoma being induced. I find myself using the figure regularly in presentations on Oklahoma earthquakes. And it is short!!

Jeremy Boak, Director  
Oklahoma Geological Survey  
Mewbourne College of Earth & Energy  
University of Oklahoma  
Sarkeys Energy Center, N119  
100 E. Boyd Street  
Norman OK 73019  
405-325-7968  
[jboak@ou.edu](mailto:jboak@ou.edu)

---

**From:** "Dorsey, Nancy" <[Dorsey.Nancy@epa.gov](mailto:Dorsey.Nancy@epa.gov)>  
**Date:** Tuesday, March 29, 2016 at 3:27 PM  
**To:** Jeremy Boak <[jboak@ou.edu](mailto:jboak@ou.edu)>  
**Subject:** RE: OGS quote on % of HF versus produced water disposed?

Please don't blame Matt for my probable misquote, mainly he directed me to the correct source. Thank you for the response.

---

**From:** Boak, Jeremy M. [<mailto:jboak@ou.edu>]  
**Sent:** Tuesday, March 29, 2016 3:25 PM  
**To:** Dorsey, Nancy <[Dorsey.Nancy@epa.gov](mailto:Dorsey.Nancy@epa.gov)>  
**Subject:** Re: OGS quote on % of HF versus produced water disposed?

A paper by Rall Walsh and Mark Zoback in Science Advances in June (attached) calculated the fraction of waste water being disposed of that constituted flowback water from hydraulic fracturing operations. This would be fresh water that has been mixed with sand (8-10%) and chemicals (~0.5%) and injected into a shallower formation to fracture the rock. A portion of this water returns to the surface when the well is produced, and it is increasingly mixed with the natural water in the producing formation. The amount is less than 5%, according to Walsh and Zoback.

The remaining 95% of the water is formation water co-produced with oil and gas. It is essentially ancient seawater from the sedimentary rocks that also contain oil and gas. In the two main plays producing the bulk of the water disposed of in Oklahoma, it is saltier than Dead Sea water (and therefore toxic), but also contains some metals dissolved from adjacent rock, and some organic contaminants as a result of coexisting with oil and gas for millions of years.

Calling this hydraulic fracturing waste would be like calling coal fly ash from a power plant construction waste.

There is no difference between produced water from formations that are hydraulically fractured and formations that are not.

To my knowledge, there is no evidence that this calculation is not appropriate or is outdated. Matt Skinner is simply wrong on this issue.

The same proportion may not be true of other areas disposing of water from oil and gas operations.

Jeremy Boak, Director  
Oklahoma Geological Survey  
Mewbourne College of Earth & Energy  
University of Oklahoma  
Sarkeys Energy Center, N119  
100 E. Boyd Street  
Norman OK 73019  
405-325-7968  
[Jboak@ou.edu](mailto:jboak@ou.edu)

---

**From:** "Dorsey, Nancy" <[Dorsey.Nancy@epa.gov](mailto:Dorsey.Nancy@epa.gov)>  
**Date:** Tuesday, March 29, 2016 at 2:52 PM  
**To:** Jeremy Boak <[jboak@ou.edu](mailto:jboak@ou.edu)>  
**Subject:** OGS quote on % of HF versus produced water disposed?

My boss has asked me to verify a quote he remembered about the low percent of hydrofracturing produced water versus other produced water reinjected. Matt Skinner told me it came from OGS, but was out-dated. Will you assist me on this quest please?

FYI, the phone number listed for you on the website does not work.

Thank you,  
Nancy

Nancy S. Dorsey  
Environmental Scientist  
Oklahoma Class II Program Manager  
WQ-SG EPA Region 6  
1445 Ross Ave. #1200  
Dallas, TX 75202-2733  
214-665-2294  
FAX 214-665-2191

UIC Webpages:

<http://www.epa.gov/uic/underground-injection-control-epa-region-6-ar-la-nm-ok-and-tx>

<http://www.epa.gov/uic/guidance-documents-completing-class-i-injection-well-no-migration-petitions>

*Managing and Minimizing Potential of Injection-Induced Seismicity from Class II Disposal: Practical*

*Approaches:* <http://www.epa.gov/uic/underground-injection-control-national-technical-workgroup-final-issue-papers>